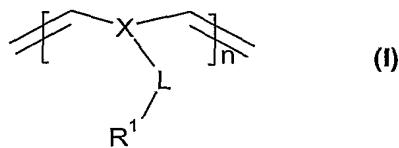


Claims

1. A method of coating the internal surface of a device with a polymer, the process comprising the steps of:
  - 5 (i) introducing into the device a solution of one or more monomers in a suitable solvent;
  - (ii) introducing a flow of an inert gas through the device; and
  - (iii) initiating polymerisation of the monomer solution.
2. A method as claimed in claim 1 wherein the device is a microfabricated device or a
  - 10 reaction vessel with an internal diameter of less than about 2mm
3. A method as claimed in claim 1 or claim 2, wherein the inert gas is nitrogen or argon.
- 15 4. A method as claimed in any one of claims 1 to 3, wherein the device is a microfabricated device or a loop from 1 to 100 cm in length.
5. A method as claimed in any one of claims 1 to 4, wherein the device is adapted to carry out a solid-phase radiochemical process.
- 20 6. A method as claimed in any one of claims 1 to 5, wherein the one or more monomers can be polymerised by ring opening metathesis polymerisation (ROMP) and the solution also includes a ruthenium carbene catalyst and a cross-linker.
- 25 7. A method as claimed in any one of claims 1 to 6, wherein polymerisation of the one or more monomers leads to a ROMP polymer of Formula (I):



wherein:

- 30 X is either a C<sub>4-6</sub> cycloalkyl or C<sub>4-6</sub> heterocyclyl moiety;

L is a C<sub>1</sub> to C<sub>20</sub> linker group comprising one or more alkyl, alkenyl, alkynyl, C<sub>4-10</sub> cycloalkyl, C<sub>4-10</sub> heterocyclyl, C<sub>4-10</sub> aryl, C<sub>4-10</sub> heteroaryl, ether, PEG, sulphide, amide, sulphamide or a combination thereof; any of which may be substituted with one or more groups R<sup>2</sup>

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R<sup>1</sup> is hydrogen, C<sub>1-20</sub> alkyl, C<sub>2-20</sub> alkenyl, C<sub>2-20</sub> alkynyl, C<sub>4-12</sub> cycloalkyl, C<sub>4-12</sub> heterocyclyl, aryl, heteroaryl, C(O)R<sup>3</sup>, C<sub>1-20</sub> alkyl-C(O)R<sup>3</sup>, C<sub>2-20</sub> alkenyl-C(O)R<sup>3</sup>, C<sub>2-20</sub> alkynyl-C(O)R<sup>3</sup>, nitro, isocyanate, C<sub>1-10</sub> alkyl-C(O)-C(R<sup>4</sup>)<sub>2</sub>-C(O)-C<sub>1-10</sub> alkyl, aminoxy, nitrile, phosphorus chloride, succinimide, sulphonyl chloride, halogen, tosylate, mesylate, triflate, nonaflate, 10 silane, OR<sup>4</sup>, SR<sup>4</sup>, N(R<sup>4</sup>)<sub>2</sub>, N<sup>+(R<sup>4</sup>)<sub>3</sub>, quaternary phosphorous, C<sub>1-20</sub> alkyl-R<sup>5</sup>, C<sub>2-20</sub> alkenyl-R<sup>5</sup> or C<sub>2-20</sub> alkynyl-R<sup>5</sup> or a group comprising an enzyme or a catalyst.</sup>

15 R<sup>2</sup> is C(O)R<sup>3</sup>, C<sub>1-20</sub> alkyl-C(O)R<sup>3</sup>, C<sub>2-20</sub> alkenyl-C(O)R<sup>3</sup>, C<sub>2-20</sub> alkynyl-C(O)R<sup>3</sup>, nitro, isocyanate, C<sub>1-10</sub> alkyl-C(O)-C(R<sup>4</sup>)<sub>2</sub>-C(O)-C<sub>1-10</sub> alkyl, aminoxy, nitrile, phosphorus chloride, succinimide, sulphonyl chloride, halogen, tosylate, mesylate, triflate, nonaflate, silane, OR<sup>4</sup>, 20 SR<sup>4</sup>, N(R<sup>4</sup>)<sub>2</sub>, N<sup>+(R<sup>4</sup>)<sub>3</sub>, quaternary phosphorous, C<sub>1-20</sub> alkyl-R<sup>5</sup>, C<sub>2-20</sub> alkenyl-R<sup>5</sup> or C<sub>2-20</sub> alkynyl-R<sup>5</sup>.</sup>

R<sup>3</sup> is H, OH, C<sub>1-20</sub> alkyl, OC<sub>1-20</sub> alkyl, N(R<sup>4</sup>)<sub>2</sub>, N<sup>+(R<sup>4</sup>)<sub>3</sub>;</sup>

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each R<sup>4</sup> is independently H or C<sub>1-10</sub> alkyl;

R<sup>5</sup> is OR<sup>4</sup>, SR<sup>4</sup>, N(R<sup>4</sup>)<sub>2</sub>, N<sup>+(R<sup>4</sup>)<sub>3</sub>, C<sub>4-10</sub> cycloalkyl, C<sub>4-10</sub> heterocyclyl, aryl or heteroaryl.</sup>

25 8. A process as claimed in claim 7, wherein, in the ROMP polymer of Formula (I):

R<sup>1</sup> is halogen, OH, SH, C<sub>1-20</sub> alkyl, C<sub>4-12</sub> aryl, C<sub>1-20</sub> alkyl-R<sup>5</sup>, C<sub>1-20</sub> alkyl-C(O)R<sup>3</sup>, N(R<sup>4</sup>)<sub>2</sub>, N<sup>+(R<sup>4</sup>)<sub>3</sub> or a group comprising an enzyme or a catalyst.</sup>

where R<sup>3</sup> is OH, R<sup>4</sup> is as defined for general formula (I) and R<sup>5</sup> is N(R<sup>4</sup>)<sub>2</sub>, N<sup>+(R<sup>4</sup>)<sub>3</sub>, aryl or heteroaryl;</sup>

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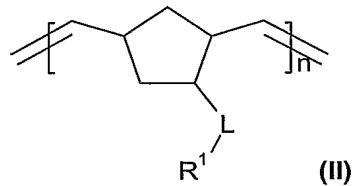
9. A process as claimed in claim 8, wherein, in the ROMP polymer of Formula (I) wherein R<sup>1</sup> is C<sub>1-20</sub> alkyl; -N=C=O, -SH or N<sup>+(R<sup>4</sup>)<sub>3</sub>, particularly with bound <sup>18</sup>F-fluoride ion</sup>

or comprises an enzyme or a catalyst; and R<sup>4</sup> is as defined in general formula (I).

10. A process as claimed in any one of claims 7 to 9, wherein the polymer of Formula (I) contains more than one R<sup>1</sup> group.

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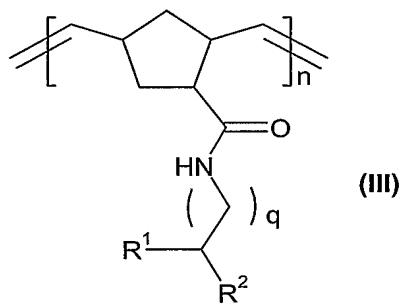
11. A process as claimed in any one of claims 1 to 10 wherein polymerisation of the one or more monomers leads to a ROMP polymer of Formula (II):



10 wherein:

-L-, R<sup>1</sup> and n are as defined above for Formula (I).

12. A process as claimed in any one of claims 1 to 11 wherein polymerisation of the one or more monomers leads to a ROMP polymer of Formula (III):



15

wherein:

R<sup>1</sup> and n are as defined above for Formula (I);

R<sup>2</sup> is an optional group as defined above for -L- of Formula (I); and,

q = 1-4.

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13. A process as claimed in claim 12, wherein, in the ROMP polymer of Formula (III), R<sup>1</sup> is trialkylammonium, R<sup>2</sup> is absent, q = 3 and n = number of polymer units.

14. A process as claimed in any one of claims 1 to 13, wherein each monomer is

present in the starting solution in a concentration of from about 0.1 to 5M.

15. A process as claimed in any one of claims 1 to 14 wherein, in the monomer solution, the solvent is a polar aprotic solvent.

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16. A process as claimed in any one of claims 1 to 15 wherein polymerisation is initiated by heating.

17. A process as claimed in any one of claims 1 to 15 wherein polymerisation occurs 10 spontaneously.

18. A process as claimed in any one of claims 1 to 17, wherein the device is a microfabricated device and, the process of the invention comprises the initial step of creating a defined network of channels within the device.

15

19. A device comprising a microfabricated device or a reaction vessel with an internal diameter of less than about 2mm, wherein the internal surface is coated with a polymer substrate for a solid phase physical or chemical process.

20. 20. A device as claimed in claim 19 adapted for carrying out a solid phase radiochemical process.

21. A device as claimed in claim 19 or claim 20, wherein the internal surface is coated with a ROMP polymer.

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22. A device as claimed in any one of claims 19 to 21, wherein the internal surface is coated with a polymer as defined in any one of claims 7 to 13.

23. An automated synthesis system comprising two or more devices as claimed in any 30 one of claims 19 to 22 which are fluidly interconnected

24. A method for recovering of  $^{18}\text{F}$ -fluoride ion from  $^{18}\text{O}$ -enriched water containing  $^{18}\text{F}$ -fluoride ion, the process comprising passing the  $^{18}\text{O}$ -enriched water containing  $^{18}\text{F}$ -fluoride

ion through a device as claimed in any one of claims 19 to 22 or a system as defined in claim 23, in which the polymer coating comprises a ROMP polymer of general formula (III) in which R<sup>1</sup> is tri(C<sub>1-6</sub> alkyl)ammonium, with a non-nucleophilic counter-ion, R<sup>2</sup> is absent and q is 3.

5 25. A method as claimed in claim 24 which is a step in the synthesis of an <sup>18</sup>F-labelled radiotracer.

26. A method for the synthesis of an <sup>18</sup>F-labelled radiotracer, the method comprising:

(i) recovering of <sup>18</sup>F-fluoride ion from <sup>18</sup>O-enriched water containing <sup>18</sup>F-fluoride ion passing the <sup>18</sup>O-enriched water containing <sup>18</sup>F-fluoride ion through a device as claimed in 10 any one of claims 19 to 22 or a device as claimed in claim 23 in which the polymer coating comprises a ROMP polymer of general formula (III) in which R<sup>1</sup> is tri(C<sub>1-6</sub> alkyl)ammonium, with a non-nucleophilic counter-ion, R<sup>2</sup> is absent and q is 3; and

15 (ii) introducing into the device an unlabelled precursor compound of the <sup>18</sup>F-labelled radiotracer such that <sup>18</sup>F becomes incorporated into the precursor compound *via* nucleophilic substitution to form the <sup>18</sup>F-labelled radiotracer.

27. A method as claimed in claim 26, wherein the <sup>18</sup>F-labelled radiotracer is:

2-[<sup>18</sup>F]fluorodeoxyglucose (2-[<sup>18</sup>F]-FDG);

L-6-[<sup>18</sup>F]fluoro-DOPA;

3'-deoxy-3'-fluorothymidine (FLT);

20 2-(1,1-dicyanopropen-2-yl)-6-(2-[<sup>18</sup>F]fluoroethyl)-methylamino)-naphthalene ([<sup>18</sup>F]FDDNP);

5[<sup>18</sup>F]fluorouracil; 5[<sup>18</sup>F]fluorocytosine; or

[<sup>18</sup>F]-1-amino-3-fluorocyclobutane-1-carboxylic acid ([<sup>18</sup>F]-FACBC).